

December 12, 2012

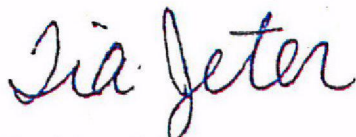
Mr. Ray Pilapil, Manager
Illinois Environmental Protection Agency
Bureau of Air, Compliance Section #40
1021 North Grand Avenue East
Springfield, IL 62702

**Re: Annual Compliance Test Report
Flare Performance Testing
Cottonwood Hills Recycling and Disposal Facility**

Dear Mr. Pilapil:

Aquaterra Environmental Solutions, Inc. (Aquaterra) on behalf of our client, Waste Management of Illinois, Inc., is submitting the attached report of the *Open Flare Annual Test Report, Cottonwood Hills Recycling and Disposal Facility, Marissa, Illinois* dated December 2012. Please contact us at (618) 628-2001 with any questions or comments regarding this report.

Sincerely,
Aquaterra Environmental Solutions, Inc.



Tia Jeter, P.E.
Project Manager



Andrew Limmer, P.G.
Senior Project Manager

Enclosures

C: Ernest Dennison, P.E. - Waste Management of Illinois, Inc.
Kevin Mattison - IEPA Bureau of Air - Des Plaines Office
John Justice - IEPA Bureau of Air - Collinsville Office

OPEN FLARE ANNUAL TEST REPORT
COTTONWOOD HILLS RECYCLING AND DISPOSAL FACILITY
MARISSA, ILLINOIS

Aquaterra Project Number 4733.11
December 2012

Prepared For:

Waste Management of Illinois, Inc.
601 Madison Avenue
East St. Louis, Illinois 62201

AQUATERRA

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**OPEN FLARE ANNUAL TEST REPORT
COTTONWOOD HILLS RECYCLING AND DISPOSAL FACILITY
MARISSA, ILLINOIS
DECEMBER 2012**

1.0 INTRODUCTION

Aquaterra Environmental Solutions, Inc. (Aquaterra) was retained by Waste Management of Illinois, Inc., to perform the 2012 annual sampling of the open flare at the Cottonwood Hills Recycling and Disposal Facility (Cottonwood Hills RDF) located in Marissa, Illinois. The flare testing was performed in accordance with the requirements of the Illinois Environmental Protection Agency (IEPA), New Source Performance Standards (NSPS), and Construction Permit No. 06100058. Tim Pool of Aquaterra performed the Cottonwood Hills RDF flare testing on January 26, 2012 and October 1, 2012.

2.0 FIELD ACTIVITIES

The Cottonwood Hills RDF landfill gas collection and control system is routed to an open landfill gas flare. The open flare is used for the destruction of landfill gas and the control of landfill gas emissions. The flare was installed per Construction Permit No. 06100058 and began operation on February 5, 2008. The flare was continually operated with a flame present at all times during the test period.

Two test events were conducted on the open flare. The test events were completed in January 2012 and October 2012. The visual test of the open flare emissions was conducted during the October 2012 event. Landfill gas samples were collected for laboratory analyses during each test event. Copies of the Cottonwood Hills RDF flare testing field logs are presented in Appendix A. Field testing information including sampling times and flare system performance data are recorded on the field logs.

Samples CWH-4, CWH-5, and CWH-6 were collected on January 26, 2012 and samples CWH #4, CWH #5, and CWH #6 were collected on October 1, 2012. The landfill gas samples were collected under vacuum at the Cottonwood Hills RDF flare inlet using evacuated stainless steel tanks (Summa canisters). A calibrated flow control regulator was used to regulate the flow of landfill gas at the approximate flow rate of 100 milliliters per minute into each evacuated Summa canister. The landfill gas sample canisters were delivered to Columbia Analytical Services (CAS) in Simi Valley, California for laboratory analysis of net heating value, nonmethane organic compounds (NMOCs) and fixed gas analysis per ASTM D3588-98, EPA Method 25C, and EPA Method 3C, respectively. Copies of the laboratory reports are presented in Appendix B.

Additional landfill gas samples CWH-1, CWH-2, CWH-3, CWH #1, CWH #2, and CWH #3 were collected on January 26, 2012 and October 1, 2012. These landfill gas samples were collected using 1.0 Liter Zefon bags at the sample port located on the Cottonwood Hills RDF flare inlet. The landfill gas samples were delivered to CAS for analysis of sulfur compounds per ASTM D5504-08. Copies of the laboratory reports are presented in Appendix B.

3.0 ANALYSIS AND RESULTS

The Cottonwood Hills RDF flare testing was performed in accordance with Construction Permit No. 06100058, NSPS, and the relevant guidelines for test methods provided at 40 CFR Part 60, Appendix A. A discussion of the results is provided in the following sections.

3.1 Visible Emissions

Visible emissions (opacity) testing of the Cottonwood Hills RDF flare was performed on October 1, 2012, in accordance with USEPA Method 22, *Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares*. The visual emissions from the open flare were continuously monitored for a 2-hour timeframe and documented at 5-minute intervals. A 5-minute rest period occurred after each 20-minute observation period. The Method 22 test result for the Cottonwood Hills RDF flare are summarized on the Method 22 Testing Field Logs presented in Appendix B. The results of the visible emissions test indicated no detectable visible emissions from the Cottonwood Hills RDF flare, therefore, the flare was operated within the maximum permitted emission limit. A summary of the acceptable Cottonwood Hills RDF flare visible emissions testing results is presented as follows.

Actual Visible Emission Event per 2 hours	Allowable Visible Emission Event per 2 hours
0 seconds	5 minutes

3.2 Fuel Heating Value

Six of the landfill gas samples collected during the January 2012 and October 2012 events were analyzed for net heating value by ASTM Method D3588 and fixed gases per EPA Method 3C. The results of the laboratory analyses are provided in Appendix B. The laboratory heating value analysis indicated the net heating value of the landfill gas at the time of sample collection was in compliance with the minimum requirements as described in 40 CFR 60.18(c)(3)(ii). The net heating value of the landfill gas during the test events was also calculated based on the concentration of methane in the landfill gas, in accordance with

**Open Flare Annual Test Report
Cottonwood Hills Recycling and Disposal Facility
December 2012**

40 CFR 60.18(f)(3) and 40 CFR 60.754(e). Per 40 CFR 60.754(e), the net heating value of combusted landfill gas is calculated from the concentration of methane in the landfill gas as measured by EPA Method 3C. The measurement of other organic components, hydrogen, and carbon monoxide is not applicable. The results of the net heating value calculation comply with the requirements of 40 CFR 60.18(c)(3)(ii) and not surprisingly are slightly less than the laboratory measured values. This is due to the fact that the calculation considers the heating value of only the methane portion of the landfill gas, while the laboratory analysis considers the heating value of all components of landfill gas contributing to the net heating value, including methane and other organic compounds. Detailed calculations are provided in Appendix C. A summary of the laboratory results, calculated heating values and allowable heating value for the Cottonwood Hills RDF flare is presented in the following table.

Date	Run No.	Laboratory Analytical Heating Value (MJ/scm)	Calculated Heating Value (MJ/scm)	Minimum Allowable Heating Value (MJ/scm)
1/26/2012	CWH-4	17.2	17.1	7.45
1/26/2012	CWH-5	18.0	17.9	7.45
1/26/2012	CWH-6	17.5	17.4	7.45
10/1/2012	CWH #4	16.3	16.1	7.45
10/1/2012	CWH #5	16.3	16.1	7.45
10/1/2012	CWH #6	16.0	15.8	7.45

MJ/scm: Mega joule per standard cubic meter

3.3 Fixed Gas Analysis

Per the requirements of Construction Permit No. 06100058, landfill gas samples collected during the January 2012 and October 2012 events were analyzed for fixed gases, including methane and carbon monoxide, by EPA Method 3C. The results of the analysis, reported as percent by volume (%), are provided in the following table.

Date Collected	1/26/2012			10/1/2012			Average
Parameter	CWH-4	CWH-5	CWH-6	CWH #4	CWH #5	CWH #6	
Hydrogen	0.8%	0.8%	0.8%	0.7%	0.7%	0.6%	0.7%
Oxygen	1.7%	0.7%	1.3%	1.1%	1.1%	1.5%	1.2%
Nitrogen	11.3%	8.1%	10.1%	13.1%	13%	14.2%	11.6%
Carbon Monoxide	ND	ND	ND	ND	ND	ND	ND
Methane	51.2%	53.5%	52%	48.2%	48.3%	47.4%	50.1%
Carbon Dioxide	35%	36.8%	35.7%	36.8%	36.9%	36.2%	36.2%

ND: Not detected at or above the reporting limit

3.4 NMOC Analysis

Per the requirements of Construction Permit No. 06100058, landfill gas samples collected during the January 2012 and October 2012 events were analyzed for NMOCs by EPA Method 25C. The laboratory results, reported as NMOC (as methane), were converted to NMOC (as hexane), to be consistent with the units reported under NSPS. To convert to the proper units, each NMOC (as methane) result was divided by six. The results of the NMOC(as methane) and calculated NMOC(as hexane) in the samples are summarized in the following table.

Date	Run No.	NMOC (as methane) (ppmv)	NMOC (as hexane) (ppmv)
1/26/12	CWH-4	3,600	600
1/26/12	CWH-5	4,800	800
1/26/12	CWH-6	4,500	750
10/1/12	CWH #4	4,900	817
10/1/12	CWH #5	5,500	917
10/1/12	CWH #6	5,200	867
Average		4,750	790

ppmv: parts per million by volume

3.5 Sulfur Compounds Analysis

A total of six landfill gas samples collected during the January 2012 and October 2012 events were analyzed for twenty sulfur compounds, including hydrogen sulfide, by ASTM Method D 5504-08. The results of the laboratory analyses are provided in Appendix B. The average sulfur content for the samples analyzed was 363.5 ppmv. A summary of the sulfur compounds tested and their concentrations is provided on the table on the following page.

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Cottonwood Hills Recycling and Disposal Facility
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Date collected	Units	1/26/2012			10/1/2012		
Parameter		CWH-1	CWH-2	CWH-3	CWH #1	CWH #2	CWH #3
Hydrogen Sulfide	ppbv	3,300	16,000	16,000	610,000	710,000	730,000
Carbonyl Sulfide	ppbv	23	76	76	2,200	210	2,700
Methyl Mercaptan	ppbv	980	4,100	3,900	10,000	750	12,000
Ethyl Mercaptan	ppbv	24	97	90	200	16	230
Dimethyl Sulfide	ppbv	3,000	10,000	9,800	9,500	740	10,000
Carbon Disulfide	ppbv	14	43	43	1,400	110	1,500
Isopropyl Mercaptan	ppbv	86	300	280	1,500	120	1,700
tert-Butyl Mercaptan	ppbv	150	460	420	350	30	380
n-Propyl Mercaptan	ppbv	14	36	32	88	6.7	100
Ethyl Methyl Sulfide	ppbv	32	98	86	64	6.2	73
Thiophene	ppbv	100	350	320	1,600	110	1,800
Isobutyl Mercaptan	ppbv	30	100	91	ND	ND	ND
Diethyl Sulfide	ppbv	ND	11	8	10	ND	9.1
n-Butyl Mercaptan	ppbv	14	52	49	48	ND	48
Dimethyl Disulfide	ppbv	33	95	83	150	12	150
3-Methylthiophene	ppbv	28	99	90	71	5.4	75
Tetrahydrothiophene	ppbv	ND	22	18	22	ND	22
2,5-Dimethylthiophene	ppbv	ND	11	7.1	26	ND	34
2-Ethylthiophene	ppbv	ND	11	6.5	8.7	ND	11
Diethyl Disulfide	ppbv	ND	ND	ND	ND	ND	ND
Total Per Sample	ppbv	7,828	31,961	31,399.6	637,237.7	712,116.3	760,832.1
Average	ppmv	363.5					

ppbv: parts per billion by volume

ppmv: parts per million by volume

ND: Not detected at or above reporting limit

APPENDIX A

FIELD LOGS

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 1/26/2012
Sample I.D. CWH-1
Vessel I.D. 90675-47506
Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1029 Deg. F

Gas Temp.** 107.3 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 2.5 Inches H2O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1305
Flow Rate* 757.9 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum _____ Inches Hg

Final Vacuum _____ Inches Hg

Start Time _____

End Time _____

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 1/26/2012
Sample I.D. CWH-2
Vessel I.D. 90675-47503
Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 964 Deg. F

Gas Temp.** 107.8 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 2.5 Inches H2O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1310
Flow Rate* 738.2 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum _____ Inches Hg

Final Vacuum _____ Inches Hg

Start Time _____

End Time _____

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 1/26/2012
Sample I.D. CWH-3
Vessel I.D. 90675-47507
Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 921 Deg. F

Gas Temp.** 107.9 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 2.5 Inches H2O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1315
Flow Rate* 835.4 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum _____ Inches Hg

Final Vacuum _____ Inches Hg

Start Time _____

End Time _____

Start Time _____

End Time _____

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 1/26/2012
Sample I.D. CWH-4
Vessel I.D. 1SC00804
Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 983 Deg. F
Gas Temp.** 106.3 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 2.5 Inches H2O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1215
Flow Rate* 839.4 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -29 Inches Hg
Final Vacuum -3 Inches Hg

Start Time 1215
End Time 1230

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 1/26/2012
Sample I.D. CWH-5
Vessel I.D. 1SC00766
Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 957 Deg. F
Gas Temp.** 107 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 2.5 Inches H2O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1230
Flow Rate* 841 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -27 Inches Hg
Final Vacuum -2 Inches Hg

Start Time 1230
End Time 1246

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 1/26/2012

Sample I.D. CWH-6

Vessel I.D. 1SC00722

Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 998 Deg. F

Gas Temp.** 108.2 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 2.5 Inches H2O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1246

Flow Rate* 839.3 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -28 Inches Hg

Final Vacuum -2 Inches Hg

Start Time 1246

End Time 1303

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 10/1/2012

Sample I.D. CHW #1

Vessel I.D. 90675-54833 Flow Controller I.D. NA

Vessel Vol. 1.0 liter bag

Temperature Measurements

Flare Temp.* 1251 Deg. F

Gas Temp.** 134 Deg. F

* Recorded From Flare Chart Recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H2O

* Measured with Inline Gauge

Flow Rate Record

Time 1350

Flow Rate* 1045 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum NA Inches Hg

Final Vacuum NA Inches Hg

Start Time NA

End Time NA

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 10/1/2012

Sample I.D. CHW #2

Vessel I.D. 90675-54834 Flow Controller I.D. NA

Vessel Vol. 1.0 liter bag

Temperature Measurements

Flare Temp.* 1249 Deg. F

Gas Temp.** 134 Deg. F

* Recorded From Flare Chart Recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H2O

* Measured with Inline Gauge

Flow Rate Record

Time 1355

Flow Rate* 1046 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum NA Inches Hg

Final Vacuum NA Inches Hg

Start Time NA

End Time NA

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 10/1/2012

Sample I.D. CHW #3

Vessel I.D. 90675-54836 Flow Controller I.D. NA

Vessel Vol. 1.0 liter bag

Temperature Measurements

Flare Temp.* 1238 Deg. F

Gas Temp.** 134 Deg. F

* Recorded From Flare Chart Recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H2O

* Measured with Inline Gauge

Flow Rate Record

Time 1400

Flow Rate* 1042 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum NA Inches Hg

Final Vacuum NA Inches Hg

Start Time NA

End Time NA

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 10/1/2012

Sample I.D. CHW #4

Vessel I.D. 1SC00442

Vessel Vol. 1.0

Flow Controller I.D. AVG02580

liter

Temperature Measurements

Flare Temp.* 1199 Deg. F

Gas Temp.** 134 Deg. F

* Recorded From Flare Chart Recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H2O

* Measured with Inline Gauge

Flow Rate Record

Time 1405

Flow Rate* 1043 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -27 Inches Hg

Final Vacuum -1 Inches Hg

Start Time 1405

End Time 1413

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 10/1/2012

Sample I.D. CHW #5

Vessel I.D. 1SC00388 Flow Controller I.D. AVG01382

Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1200 Deg. F

Gas Temp.** 134 Deg. F

* Recorded From Flare Chart Recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H2O

* Measured with Inline Gauge

Flow Rate Record

Time 1415

Flow Rate* 1043 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -27 Inches Hg

Final Vacuum -1 Inches Hg

Start Time 1415

End Time 1425

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 10/1/2012

Sample I.D. CHW #6

Vessel I.D. 1SC00364 Flow Controller I.D. AVG02399

Vessel Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1204 Deg. F

Gas Temp.** 134 Deg. F

* Recorded From Flare Chart Recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H2O

* Measured with Inline Gauge

Flow Rate Record

Time 1430

Flow Rate* 1042 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -27 Inches Hg

Final Vacuum -2 Inches Hg

Start Time 1430

End Time 1441

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

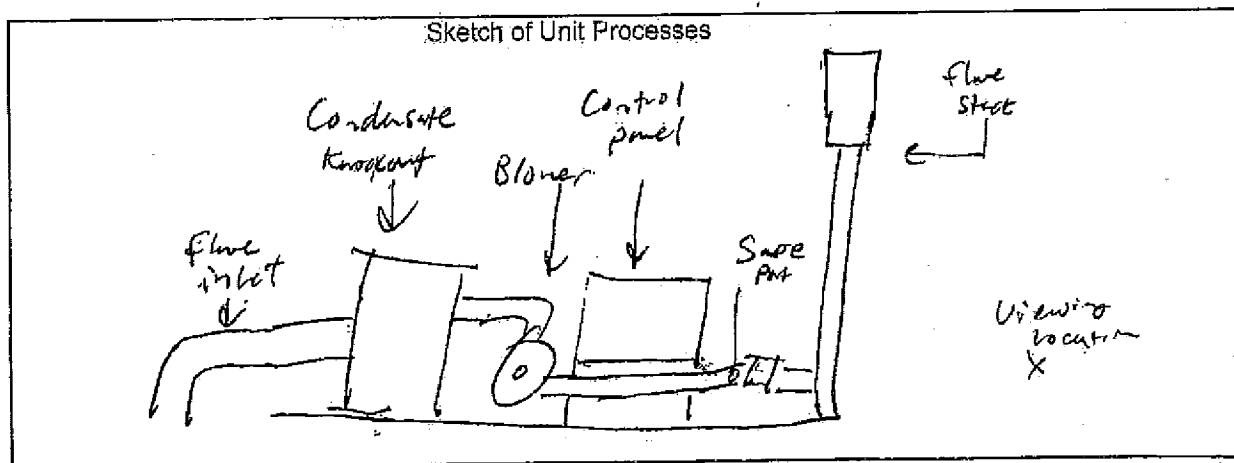
VISIBLE EMISSIONS INSPECTION - METHOD 22

Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Tester Tim Pool Date 10/1/2012

Time (Hour:Min.)	Elapsed Time (Minutes)	Accumulate Emissions (Min.:Sec.)	Time (Hour:Min.)	Elapsed Time (Minutes)	Accumulate Emissions (Min.:Sec.)
1115	0		1230	60	
1120	5	0:00	1235	65	0:00
1125	10	0:00	1240	70	0:00
1130	15	0:00	1245	75	0:00
1135	20	0:00	1250	80	0:00
1140	20		1255	80	
1145	25	0:00	1300	85	0:00
1150	30	0:00	1305	90	0:00
1155	35	0:00	1310	95	0:00
1200	40	0:00	1315	100	0:00
1205	40		1320	100	
1210	45	0:00	1325	105	0:00
1215	50	0:00	1330	110	0:00
1220	55	0:00	1335	115	0:00
1225	60	0:00	1340	120	0:00
First Hour Subtotal:		0:0	Second Hour Subtotal:		0:00
Total Visible Emissions:					0:00

Notes:



APPENDIX B

LABORATORY REPORTS

HEATING VALUE, FIXED GASES, AND NMOC ANALYSIS

LABORATORY REPORT

February 10, 2012

Tim Pool
Aquaterra Environmental Solutions, Inc.
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: Cottonwood Hills Flare Gas Sample / 4733.11

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on January 31, 2012. For your reference, these analyses have been assigned our service request number P1200364.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA20007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L10-3-R2; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-11-2; Minnesota Department of Health, NELAP Certificate No. 362188; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA015272011-1; Los Angeles Department of Building and Safety, Approval No: TA00001. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

Columbia Analytical Services, Inc.

Sue Anderson
Project Manager

Client: Aquaterra Environmental Solutions, Inc.
Project: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project No: P1200364

CASE NARRATIVE

The samples were received intact under chain of custody on January 31, 2012 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

BTU and CHONS Analysis

The results for BTU and CHONS were generated according to ASTM D 3588-98. The following analyses were performed and used to calculate the BTU and CHONS results.

C2 through C6 Hydrocarbon Analysis

The samples were analyzed according to modified EPA Method TO-3 for C2 through >C6 hydrocarbons using a gas chromatograph equipped with a flame ionization detector (FID).

Fixed Gases Analysis

The samples were also analyzed for fixed gases (hydrogen, oxygen/argon, nitrogen, carbon monoxide, methane and carbon dioxide) according to modified EPA Method 3C (single injection) using a gas chromatograph equipped with a thermal conductivity detector (TCD).

Hydrogen Sulfide Analysis

The samples were also analyzed for hydrogen sulfide per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD).

Total Gaseous Non-Methane Organics as Methane Analysis

The samples were analyzed for total gaseous non-methane organics as methane according to modified EPA Method 25C. The analyses included a single sample injection (method modification) analyzed by gas chromatography using flame ionization detection/total combustion analysis.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

Use of Columbia Analytical Services, Inc. (CAS) Name. Client shall not use CAS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to CAS any test result, tolerance or specification derived from CAS's data ("Attribution") without CAS's prior written consent, which may be withheld by CAS for any reason in its sole discretion. To request CAS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If CAS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use CAS's name or trademark in any Materials or Attribution shall be deemed denied. CAS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of CAS's name or trademark may cause CAS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

DETAIL SUMMARY REPORT

Client: Aquaterra Environmental Solutions, Inc.
Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

Service Request: P1200364

Date Received: 1/31/2012
Time Received: 09:10

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	Container ID	Pi1 (psig)	Pf1 (psig)	TO-3 Modified - C1C6+ Can	3C Modified - Fxd Gases Can	ASTM D5504-01 - H2S Can	25C Modified - TGNMO+ 1X Can
CWH-4	P1200364-001	Air	1/26/2012	12:15	1SC00804	-0.24	6.60	X	X	X	X
CWH-5	P1200364-002	Air	1/26/2012	12:30	1SC00766	0.03	5.81	X	X	X	X
CWH-6	P1200364-003	Air	1/26/2012	12:46	1SC00722	0.01	6.42	X	X	X	X

Air - Chain of Custody Record & Analytical Service Request

Requested Turnaround Time in Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard										CAS Project No. P1202364		
Company Name & Address (Reporting Information) Aquatica Environmental Solutions Inc 13 Executive Dr. Suite 1 Fairview Heights IL 62208				Project Name Cottonwood Hills Flare Gas Sample Project Number 4733.11				CAS Contact:		Analysis Method As per D7588 Holding Volume NMOC EPA 25C OTHER EPA 3010-3		Comments e.g. Actual Preservative or specific instructions
								Project Manager Tim Pool				
Phone 618-628-2001		Fax 618-628-2002		Sampler (Print & Sign) Tim Pool								
Email Address for Result Reporting tpool@aquatica-env.com												
Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume				
CWH-4	①-040	1-26-12	1215	1500804	909569	-29	-3	1L	X	X		
CWH-5	②-011	1-26-12	1230	15100766	909569	-27	-2	1L	X	X		
CWH-6	③-009	1-26-12	1246	1500722	496202	-28	-2	1L	X	X		
Report Tier Levels - please select Tier I - Results (Default if not specified) <input checked="" type="checkbox"/> X Tier II (Results + QC Summaries) _____ Tier III (Results + QC & Calibration Summaries) _____ Tier IV (Data Validation Package) 10% Surcharge _____ EDD required Yes / No Type: _____												Project Requirements (MRLs, QAPP)
Relinquished by: (Signature)				Date: 1-26-12	Time: 1400	Received by: (Signature)			Date: 1/31/12	Time: 0910	Cooler / Blank Temperature _____ °C	
Relinquished by: (Signature)				Date:	Time:	Received by: (Signature)			Date:	Time:		

WM00639

Sample Acceptance Check Form

Client: Aquaterra Environmental Solutions, Inc. Work order: P1200364
Project: Cottonwood Hills Flare Gas Sample / 4733.11
Sample(s) received on: 1/31/12 Date opened: 1/31/12 by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by CAS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1200364-001.01	1.0 L Source Can					
P1200364-002.01	1.0 L Source Can					
P1200364-003.01	1.0 L Source Can					

Explain any discrepancies: (include lab sample ID numbers): _____

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-4
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
CAS Sample ID: P1200364-001

Test Code: ASTM D3588-98
Analyst: Dante Munoz-Castaneda/Lauryn Keeler
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00804

Date Collected: 1/26/12
Date Received: 1/31/12

Initial Pressure (psig): -0.24 **Final Pressure (psig):** 6.60

Canister Dilution Factor: 1.47

Components	Result	Result	Data Qualifier
	Volume %	Weight %	
Hydrogen	0.76	0.06	
Oxygen + Argon	1.68	1.96	
Nitrogen	11.33	11.59	
Carbon Monoxide	< 0.01	< 0.01	
Methane	51.17	29.98	
Carbon Dioxide	35.03	56.32	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	0.01	
Hexanes	< 0.01	0.01	
> Hexanes	< 0.01	0.04	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.19	37.88
Hydrogen	53.11	7.61
Oxygen + Argon	18.88	42.92
Nitrogen	5.83	11.60
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9451
Specific Volume	ft ³ /lb	13.86
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	521.9
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	469.8
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	511.4
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	460.4
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	7,235.3
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,513.1
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9973

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-5
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
CAS Sample ID: P1200364-002

Test Code: ASTM D3588-98
Analyst: Dante Munoz-Castaneda/Lauryn Keeler
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00766

Date Collected: 1/26/12
Date Received: 1/31/12

Initial Pressure (psig): 0.03 **Final Pressure (psig):** 5.81

Canister Dilution Factor: 1.39

Components	Result	Result	Data Qualifier
	Volume %	Weight %	
Hydrogen	0.82	0.06	
Oxygen + Argon	0.74	0.87	
Nitrogen	8.11	8.31	
Carbon Monoxide	< 0.01	< 0.01	
Methane	53.50	31.40	
Carbon Dioxide	36.77	59.21	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	0.02	
Hexanes	< 0.01	0.02	
> Hexanes	0.02	0.08	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.73	39.77
Hydrogen	54.34	7.98
Oxygen + Argon	18.85	43.94
Nitrogen	4.08	8.32
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9437
Specific Volume	ft ³ /lb	13.88
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	546.7
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	492.2
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	535.7
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	482.2
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	7,591.0
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,833.6
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9972

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-6
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
CAS Sample ID: P1200364-003

Test Code: ASTM D3588-98
Analyst: Dante Munoz-Castaneda/Lauryn Keeler
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00722

Date Collected: 1/26/12
Date Received: 1/31/12

Initial Pressure (psig): 0.01 Final Pressure (psig): 6.42

Canister Dilution Factor: 1.44

Components	Result	Result	Data Qualifier
	Volume %	Weight %	
Hydrogen	0.79	0.06	
Oxygen + Argon	1.31	1.53	
Nitrogen	10.11	10.34	
Carbon Monoxide	< 0.01	< 0.01	
Methane	52.03	30.50	
Carbon Dioxide	35.71	57.43	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	0.02	
Hexanes	< 0.01	0.02	
> Hexanes	0.02	0.07	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.40	38.60
Hydrogen	53.58	7.75
Oxygen + Argon	18.87	43.30
Nitrogen	5.15	10.35
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9448
Specific Volume	ft ³ /lb	13.87
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	531.4
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	478.4
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	520.7
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	468.8
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	7,369.7
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,634.3
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9973

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-4
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
 CAS Sample ID: P1200364-001

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Dante Munoz-Castaneda
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00804

Date Collected: 1/26/12
Date Received: 1/31/12
Date Analyzed: 2/3/12
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -0.24 **Final Pressure (psig):** 6.60

Canister Dilution Factor: 1.47

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.765	0.15	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.68	0.15	
7727-37-9	Nitrogen	11.3	0.15	
630-08-0	Carbon Monoxide	ND	0.15	
74-82-8	Methane	51.2	0.15	
124-38-9	Carbon Dioxide	35.0	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-5
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
CAS Sample ID: P1200364-002

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Dante Munoz-Castaneda
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00766

Date Collected: 1/26/12
Date Received: 1/31/12
Date Analyzed: 2/3/12
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): 0.03 **Final Pressure (psig):** 5.81

Canister Dilution Factor: 1.39

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.820	0.14	
7782-44-7	Oxygen +			
7440-37-1	Argon	0.741	0.14	
7727-37-9	Nitrogen	8.11	0.14	
630-08-0	Carbon Monoxide	ND	0.14	
74-82-8	Methane	53.5	0.14	
124-38-9	Carbon Dioxide	36.8	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-6
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
CAS Sample ID: P1200364-003

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Dante Munoz-Castaneda
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00722

Date Collected: 1/26/12
Date Received: 1/31/12
Date Analyzed: 2/3/12
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): 0.01 Final Pressure (psig): 6.42

Canister Dilution Factor: 1.44

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.794	0.14	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.31	0.14	
7727-37-9	Nitrogen	10.1	0.14	
630-08-0	Carbon Monoxide	ND	0.14	
74-82-8	Methane	52.0	0.14	
124-38-9	Carbon Dioxide	35.7	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
 CAS Sample ID: P120203-MB

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Dante Munoz-Castaneda
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 2/03/12
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	ND	0.10	
7782-44-7	Oxygen +			
7440-37-1	Argon	ND	0.10	
7727-37-9	Nitrogen	ND	0.10	
630-08-0	Carbon Monoxide	ND	0.10	
74-82-8	Methane	ND	0.10	
124-38-9	Carbon Dioxide	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
 CAS Sample ID: P120203-LCS

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Dante Munoz-Castaneda
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 2/03/12
Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppmV	Result ppmV	% Recovery	CAS Acceptance Limits	Data Qualifier
1333-74-0	Hydrogen	40,300	38,500	96	83-122	
7782-44-7	Oxygen +					
7440-37-1	Argon	50,000	49,800	100	74-132	
7727-37-9	Nitrogen	49,800	51,200	103	76-126	
630-08-0	Carbon Monoxide	49,900	50,500	101	84-113	
74-82-8	Methane	40,300	41,700	103	84-113	
124-38-9	Carbon Dioxide	50,000	50,200	100	87-117	

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364

Total Gaseous Nonmethane Organics (TGNMO) as Methane

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Lauryn Keeler
Sampling Media: 1.0 L Summa Canister(s)
Test Notes:

Date(s) Collected: 1/26/12
Date Received: 1/31/12
Date Analyzed: 2/2 - 2/10/12

Client Sample ID	CAS Sample ID	Canister Dilution Factor	Injection Volume ml(s)	Result ppmV	MRL ppmV	Data Qualifier
CWH-4	P1200364-001	1.47	0.50	3,600	1.5	
CWH-5	P1200364-002	1.39	0.50	4,800	1.4	
CWH-6	P1200364-003	1.44	0.50	4,500	1.4	
Method Blank	P120202-MB	1.00	0.50	ND	1.0	
Method Blank	P120210-MB	1.00	0.50	ND	1.0	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
 CAS Sample ID: P120202-LCS

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Lauryn Keeler
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 2/02/12
Volume(s) Analyzed: NA ml(s)

Compound	Spike Amount ppmV	Result ppmV	% Recovery	CAS	Data Qualifier
				Acceptance Limits	
Total Gaseous Nonmethane Organics (TGNMO) as Methane	98.8	118	119	71-136	

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200364
 CAS Sample ID: P120210-LCS

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Dante Munoz-Castaneda
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 2/10/12
Volume(s) Analyzed: NA ml(s)

Compound	Spike Amount ppmV	Result ppmV	% Recovery	CAS	Data Qualifier
				Acceptance Limits	
Total Gaseous Nonmethane Organics (TGNMO) as Methane	98.8	114	115	71-136	

LABORATORY REPORT

October 10, 2012

Tim Pool
Aquaterra Environmental Solutions, Inc.
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: Cottonwood Hills 2012 Flare Testing / 4733.11

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on October 4, 2012. For your reference, these analyses have been assigned our service request number P1204087.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA200007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L11-203; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-12-3; Minnesota Department of Health, NELAP Certificate No. 362188; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA01527Z012-Z; Los Angeles Department of Building and Safety, Approval No: TA00001. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Sue Anderson
Project Manager

Client: Aquaterra Environmental Solutions, Inc. Service Request No: P1204087
Project: Cottonwood Hills 2012 Flare Testing / 4733.11

CASE NARRATIVE

The samples were received intact under chain of custody on October 4, 2012 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

BTU and CHONS Analysis

The results for BTU and CHONS were generated according to ASTM D 3588-98. The following analyses were performed and used to calculate the BTU and CHONS results.

C2 through C6 Hydrocarbon Analysis

The samples were analyzed according to modified EPA Method TO-3 for C₂ through >C₆ hydrocarbons using a gas chromatograph equipped with a flame ionization detector (FID).

Fixed Gases Analysis

The samples were also analyzed for fixed gases (hydrogen, oxygen/argon, nitrogen, carbon monoxide, methane and carbon dioxide) according to ASTM D 1946 using a gas chromatograph equipped with a thermal conductivity detector (TCD).

Hydrogen Sulfide Analysis

The were also analyzed for hydrogen sulfide per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD).

Total Gaseous Non-Methane Organics as Methane Analysis

The samples were also analyzed for total gaseous non-methane organics as methane according to modified EPA Method 25C. The analyses included a single sample injection (method modification) analyzed by gas chromatography using flame ionization detection/total combustion analysis.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

Use of Columbia Analytical Services, Inc. dba ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to AALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

DETAIL SUMMARY REPORT

Client: Aquaterra Environmental Solutions, Inc.
Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

Service Request: P1204087

Date Received: 10/4/2012
Time Received: 09:15

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	Container ID	P _i l (psig)	P _f l (psig)	TO-3 Modified - C1C6+ Can	3C Modified - Fxd Gases Can	ASTM D5504-01 - H2S Can	25C Modified - TGNMO+ 1X Can
CWH #4	P1204087-001	Air	10/1/2012	14:05	1SC00442	-0.98	6.52	X	X	X	X
CWH #5	P1204087-002	Air	10/1/2012	14:15	1SC00388	-1.47	5.34	X	X	X	X
CWH #6	P1204087-003	Air	10/1/2012	14:30	1SC00364	-1.59	5.05	X	X	X	X

Sample Acceptance Check Form

Client: Aquaterra Environmental Solutions, Inc.

Work order: P1204087

Project: Cottonwood Hills 2012 Flare Testing / 4733.11

Sample(s) received on: 10/4/12

Date opened: 10/4/12

by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by CAS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1204087-001.01	1.0 L Source Can					
P1204087-002.01	1.0 L Source Can					
P1204087-003.01	1.0 L Source Can					

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #4
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
CAS Sample ID: P1204087-001

Test Code: ASTM D3588-98
Analyst: Zheng Wang/Wade Henton/Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00442

Date Collected: 10/1/12
Date Received: 10/4/12

Initial Pressure (psig): -0.98 **Final Pressure (psig):** 6.52

Canister Dilution Factor: 1.55

Components	Result	Result	Data Qualifier
	Volume %	Weight %	
Hydrogen	0.66	0.05	
Oxygen + Argon	1.14	1.30	
Nitrogen	13.09	13.07	
Carbon Monoxide	< 0.01	< 0.01	
Methane	48.21	27.56	
Carbon Dioxide	36.80	57.73	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	0.01	
Butanes	< 0.01	0.01	
Pentanes	0.02	0.04	
Hexanes	0.01	0.04	
> Hexanes	0.04	0.18	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.31	36.59
Hydrogen	51.04	7.03
Oxygen + Argon	19.81	43.30
Nitrogen	6.84	13.08
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9687
Specific Volume	ft ³ /lb	13.53
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	494.9
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	445.6
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	484.9
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	436.6
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,693.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,026.5
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9973

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #5
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
CAS Sample ID: P1204087-002

Test Code: ASTM D3588-98
Analyst: Zheng Wang/Wade Henton/Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00388

Date Collected: 10/1/12
Date Received: 10/4/12

Initial Pressure (psig): -1.47 Final Pressure (psig): 5.34

Canister Dilution Factor: 1.51

Components	Result	Result	Data Qualifier
	Volume %	Weight %	
Hydrogen	0.66	0.05	
Oxygen + Argon	1.11	1.27	
Nitrogen	12.99	12.97	
Carbon Monoxide	< 0.01	< 0.01	
Methane	48.28	27.60	
Carbon Dioxide	36.86	57.81	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	0.01	
Butanes	< 0.01	0.01	
Pentanes	0.02	0.04	
Hexanes	0.01	0.04	
> Hexanes	0.04	0.18	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.32	36.65
Hydrogen	51.08	7.04
Oxygen + Argon	19.81	43.33
Nitrogen	6.78	12.98
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9687
Specific Volume	ft ³ /lb	13.53
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	495.6
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	446.3
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	485.7
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	437.3
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,703.6
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,035.9
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9973

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #6
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
CAS Sample ID: P1204087-003

Test Code: ASTM D3588-98
Analyst: Zheng Wang/Wade Henton/Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00364

Date Collected: 10/1/12
Date Received: 10/4/12

Initial Pressure (psig): -1.59 **Final Pressure (psig):** 5.05

Canister Dilution Factor: 1.51

Components	Result	Result	Data Qualifier
	Volume %	Weight %	
Hydrogen	0.65	0.05	
Oxygen + Argon	1.49	1.69	
Nitrogen	14.21	14.18	
Carbon Monoxide	< 0.01	< 0.01	
Methane	47.39	27.08	
Carbon Dioxide	36.17	56.71	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	0.01	
Butanes	< 0.01	0.01	
Pentanes	0.02	0.04	
Hexanes	0.01	0.04	
> Hexanes	0.04	0.18	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.11	35.95
Hydrogen	50.59	6.90
Oxygen + Argon	19.83	42.95
Nitrogen	7.48	14.19
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9691
Specific Volume	ft ³ /lb	13.52
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	486.4
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	438.0
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	476.7
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	429.2
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,576.1
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	5,921.0
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9973

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #4
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
 CAS Sample ID: P1204087-001

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00442

Date Collected: 10/1/12
Date Received: 10/4/12
Date Analyzed: 10/5/12
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -0.98 **Final Pressure (psig):** 6.52

Canister Dilution Factor: 1.55

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.659	0.16	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.14	0.16	
7727-37-9	Nitrogen	13.1	0.16	
630-08-0	Carbon Monoxide	ND	0.16	
74-82-8	Methane	48.2	0.16	
124-38-9	Carbon Dioxide	36.8	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #5
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
CAS Sample ID: P1204087-002

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00388

Date Collected: 10/1/12
Date Received: 10/4/12
Date Analyzed: 10/5/12
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -1.47 **Final Pressure (psig):** 5.34

Canister Dilution Factor: 1.51

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.658	0.15	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.11	0.15	
7727-37-9	Nitrogen	13.0	0.15	
630-08-0	Carbon Monoxide	ND	0.15	
74-82-8	Methane	48.3	0.15	
124-38-9	Carbon Dioxide	36.9	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #6
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
CAS Sample ID: P1204087-003

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00364

Date Collected: 10/1/12
Date Received: 10/4/12
Date Analyzed: 10/5/12
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -1.59 Final Pressure (psig): 5.05

Canister Dilution Factor: 1.51

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.648	0.15	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.49	0.15	
7727-37-9	Nitrogen	14.2	0.15	
630-08-0	Carbon Monoxide	ND	0.15	
74-82-8	Methane	47.4	0.15	
124-38-9	Carbon Dioxide	36.2	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
 CAS Sample ID: P121005-MB

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 10/05/12
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	ND	0.10	
7782-44-7	Oxygen +			
7440-37-1	Argon	ND	0.10	
7727-37-9	Nitrogen	ND	0.10	
630-08-0	Carbon Monoxide	ND	0.10	
74-82-8	Methane	ND	0.10	
124-38-9	Carbon Dioxide	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
 CAS Sample ID: P121005-LCS

Test Code: EPA Method 3C Modified
 Instrument ID: HP5890 II/GC1/TCD
 Analyst: Jennifer Young
 Sampling Media: 1.0 L Summa Canister
 Test Notes:

Date Collected: NA
 Date Received: NA
 Date Analyzed: 10/05/12
 Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppmV	Result ppmV	% Recovery	CAS Acceptance Limits	Data Qualifier
1333-74-0	Hydrogen	40,000	37,200	93	75-117	
7782-44-7	Oxygen +					
7440-37-1	Argon	50,000	50,000	100	85-111	
7727-37-9	Nitrogen	50,000	51,400	103	85-114	
630-08-0	Carbon Monoxide	50,000	51,000	102	85-119	
74-82-8	Methane	40,000	41,800	105	90-114	
124-38-9	Carbon Dioxide	50,000	47,800	96	84-113	

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087

Total Gaseous Nonmethane Organics (TGNMO) as Methane

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister(s)
Test Notes:

Date(s) Collected: 10/1/12
Date Received: 10/4/12
Date Analyzed: 10/5/12

Client Sample ID	CAS Sample ID	Canister Dilution Factor	Injection Volume ml(s)	Result ppmV	MRL ppmV	Data Qualifier
CWH #4	P1204087-001	1.55	0.50	4,900	1.6	
CWH #5	P1204087-002	1.51	0.50	5,500	1.5	
CWH #6	P1204087-003	1.51	0.50	5,200	1.5	
Method Blank	P121005-MB	1.00	0.50	ND	1.0	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
 CAS Sample ID: P121005-LCS

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 10/05/12
Volume(s) Analyzed: NA ml(s)

Compound	Spike Amount ppmV	Result ppmV	% Recovery	CAS Acceptance Limits	Data Qualifier
Total Gaseous Nonmethane Organics (TGNMO) as Methane	124	118	95	71-136	

LABORATORY DUPLICATE SUMMARY RESULTS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #6
Client Project ID: Cottonwood Hills 2012 Flare Testing / 4733.11

CAS Project ID: P1204087
 CAS Sample ID: P1204087-003DUP

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00364

Date Collected: 10/1/12
Date Received: 10/4/12
Date Analyzed: 10/5/12
Volume(s) Analyzed: 0.50 ml(s)

Initial Pressure (psig): -1.59 Final Pressure (psig): 5.05

Canister Dilution Factor: 1.51

Compound	Duplicate		Average	% RPD	RPD Limit	Data Qualifier
	Sample Result ppmV	Sample Result ppmV				
Total Gaseous Nonmethane Organics (TGNMO) as Methane	5,220	4,940	5080	6	14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

SULFUR COMPOUNDS ANALYSIS

LABORATORY REPORT

February 9, 2012

Tim Pool
Aquaterra Environmental Solutions, Inc.
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: Cottonwood Hills Flare Gas Sample / 4733.11

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on January 27, 2012. For your reference, these analyses have been assigned our service request number P1200302.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA20007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L10-3-R2; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-11-2; Minnesota Department of Health, NELAP Certificate No. 362188; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA015272011-1; Los Angeles Department of Building and Safety, Approval No: TA00001. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

Columbia Analytical Services, Inc.

Sue Anderson
Project Manager

Client: Aquaterra Environmental Solutions, Inc.
Project: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project No: P1200302

CASE NARRATIVE

The samples were received intact under chain of custody on January 27, 2012 and were stored in accordance with the analytical method requirements. The valve on sample CWH-1 (P1200302-001) was found to be open upon receipt at the laboratory. The valve was closed upon receipt and enough volume was present to analyze per client instruction. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Sulfur Analysis

The samples were analyzed for twenty sulfur compounds per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide are quantitated against the initial calibration curve for methyl mercaptan.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

Use of Columbia Analytical Services, Inc. (CAS) Name. Client shall not use CAS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to CAS any test result, tolerance or specification derived from CAS's data ("Attribution") without CAS's prior written consent, which may be withheld by CAS for any reason in its sole discretion. To request CAS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If CAS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use CAS's name or trademark in any Materials or Attribution shall be deemed denied. CAS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of CAS's name or trademark may cause CAS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

DETAIL SUMMARY REPORT

Client: Aquaterra Environmental Solutions, Inc.
Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

Service Request: P1200302

Date Received: 1/27/2012
Time Received: 09:30

ASTM D5504-01 - Sulfur Bag

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	
CWH-1	P1200302-001	Air	1/26/2012	13:05	X
CWH-2	P1200302-002	Air	1/26/2012	13:10	X
CWH-3	P1200302-003	Air	1/26/2012	13:15	X



Page _____ of _____

1 of 11

WM100672

Sample Acceptance Check Form

Client: Aquaterra Environmental Solutions, Inc. Work order: P1200302
Project: Cottonwood Hills Flare Gas Sample / 4733.11
Sample(s) received on: 1/27/12 Date opened: 1/27/12 by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by CAS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1200302-001.01	1 L Zefon Bag					Received Tedlar bag with valve open
P1200302-002.01	1 L Zefon Bag					
P1200302-003.01	1 L Zefon Bag					

Explain any discrepancies: (include lab sample ID numbers): _____

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-1
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200302
 CAS Sample ID: P1200302-001

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: 1/26/12
Time Collected: 13:05
Date Received: 1/27/12
Date Analyzed: 1/27/12
Time Analyzed: 11:38
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	4,600	7.0	3,300	5.0	
463-58-1	Carbonyl Sulfide	57	12	23	5.0	
74-93-1	Methyl Mercaptan	1,900	9.8	980	5.0	
75-08-1	Ethyl Mercaptan	61	13	24	5.0	
75-18-3	Dimethyl Sulfide	7,600	13	3,000	5.0	
75-15-0	Carbon Disulfide	42	7.8	14	2.5	
75-33-2	Isopropyl Mercaptan	270	16	86	5.0	
75-66-1	tert-Butyl Mercaptan	560	18	150	5.0	
107-03-9	n-Propyl Mercaptan	44	16	14	5.0	
624-89-5	Ethyl Methyl Sulfide	99	16	32	5.0	
110-02-1	Thiophene	360	17	100	5.0	
513-44-0	Isobutyl Mercaptan	110	18	30	5.0	W
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	53	18	14	5.0	
624-92-0	Dimethyl Disulfide	130	9.6	33	2.5	
616-44-4	3-Methylthiophene	110	20	28	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

W = Result quantified, but the corresponding peak was detected outside of generated retention time window.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-2
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200302
 CAS Sample ID: P1200302-002

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: 1/26/12
Time Collected: 13:10
Date Received: 1/27/12
Date Analyzed: 1/27/12
Time Analyzed: 11:59
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	22,000	7.0	16,000	5.0	
463-58-1	Carbonyl Sulfide	190	12	76	5.0	
74-93-1	Methyl Mercaptan	8,100	9.8	4,100	5.0	
75-08-1	Ethyl Mercaptan	250	13	97	5.0	
75-18-3	Dimethyl Sulfide	26,000	13	10,000	5.0	
75-15-0	Carbon Disulfide	130	7.8	43	2.5	
75-33-2	Isopropyl Mercaptan	920	16	300	5.0	
75-66-1	tert-Butyl Mercaptan	1,700	18	460	5.0	
107-03-9	n-Propyl Mercaptan	110	16	36	5.0	
624-89-5	Ethyl Methyl Sulfide	300	16	98	5.0	
110-02-1	Thiophene	1,200	17	350	5.0	
513-44-0	Isobutyl Mercaptan	370	18	100	5.0	W
352-93-2	Diethyl Sulfide	39	18	11	5.0	
109-79-5	n-Butyl Mercaptan	190	18	52	5.0	
624-92-0	Dimethyl Disulfide	370	9.6	95	2.5	
616-44-4	3-Methylthiophene	400	20	99	5.0	
110-01-0	Tetrahydrothiophene	78	18	22	5.0	
638-02-8	2,5-Dimethylthiophene	51	23	11	5.0	
872-55-9	2-Ethylthiophene	49	23	11	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

W = Result quantified, but the corresponding peak was detected outside of generated retention time window.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-3
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200302
CAS Sample ID: P1200302-003

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: 1/26/12
Time Collected: 13:15
Date Received: 1/27/12
Date Analyzed: 1/27/12
Time Analyzed: 12:22
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	22,000	7.0	16,000	5.0	
463-58-1	Carbonyl Sulfide	190	12	76	5.0	
74-93-1	Methyl Mercaptan	7,600	9.8	3,900	5.0	
75-08-1	Ethyl Mercaptan	230	13	90	5.0	
75-18-3	Dimethyl Sulfide	25,000	13	9,800	5.0	
75-15-0	Carbon Disulfide	130	7.8	43	2.5	
75-33-2	Isopropyl Mercaptan	870	16	280	5.0	
75-66-1	tert-Butyl Mercaptan	1,500	18	420	5.0	
107-03-9	n-Propyl Mercaptan	100	16	32	5.0	
624-89-5	Ethyl Methyl Sulfide	270	16	86	5.0	
110-02-1	Thiophene	1,100	17	320	5.0	
513-44-0	Isobutyl Mercaptan	340	18	91	5.0	W
352-93-2	Diethyl Sulfide	29	18	8.0	5.0	
109-79-5	n-Butyl Mercaptan	180	18	49	5.0	
624-92-0	Dimethyl Disulfide	320	9.6	83	2.5	
616-44-4	3-Methylthiophene	360	20	90	5.0	
110-01-0	Tetrahydrothiophene	65	18	18	5.0	
638-02-8	2,5-Dimethylthiophene	33	23	7.1	5.0	
872-55-9	2-Ethylthiophene	30	23	6.5	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

W = Result quantified, but the corresponding peak was detected outside of generated retention time window.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200302
CAS Sample ID: P120127-MB

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: NA
Time Collected: NA
Date Received: NA
Date Analyzed: 1/27/12
Time Analyzed: 08:22
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200302
 CAS Sample ID: P120127-LCS

Test Code: ASTM D 5504-08
 Instrument ID: Agilent 6890A/GC13/SCD
 Analyst: Wade Henton
 Sampling Media: 1 L Zefon Bag
 Test Notes:

Date Collected: NA
 Date Received: NA
 Date Analyzed: 1/27/12
 Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppbV	Result ppbV	% Recovery	CAS	Data Qualifier
					Acceptance Limits	
7783-06-4	Hydrogen Sulfide	2,380	1,780	75	51-141	
463-58-1	Carbonyl Sulfide	2,470	1,700	69	63-147	
74-93-1	Methyl Mercaptan	2,360	2,110	89	54-156	

LABORATORY DUPLICATE SUMMARY RESULTS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-3
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.11

CAS Project ID: P1200302
CAS Sample ID: P1200302-003DUP

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: 1/26/12
Time Collected: 13:15
Date Received: 1/27/12
Date Analyzed: 1/27/12
Time Analyzed: 12:48
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Sample Result		Duplicate Sample Result		Average ppbV	% RPD	RPD Limit	Data Qualifier
		µg/m³	ppbV	µg/m³	ppbV				
7783-06-4	Hydrogen Sulfide	22,400	16,100	22,700	16,300	16200	1	34	
463-58-1	Carbonyl Sulfide	187	76.2	186	75.7	75.95	0.7	35	
74-93-1	Methyl Mercaptan	7,650	3,890	7,570	3,850	3870	1	41	
75-08-1	Ethyl Mercaptan	229	90.0	233	91.6	90.8	2	41	
75-18-3	Dimethyl Sulfide	25,000	9,830	24,500	9,650	9740	2	41	
75-15-0	Carbon Disulfide	133	42.7	123	39.6	41.15	8	41	
75-33-2	Isopropyl Mercaptan	870	280	861	277	278.5	1	41	
75-66-1	tert-Butyl Mercaptan	1,540	419	1,500	406	412.5	3	41	
107-03-9	n-Propyl Mercaptan	99.6	32.0	96.1	30.9	31.45	3	41	
624-89-5	Ethyl Methyl Sulfide	268	86.0	282	90.7	88.35	5	41	
110-02-1	Thiophene	1,090	318	1,050	305	311.5	4	41	
513-44-0	Isobutyl Mercaptan	336	91.2	342	92.7	91.95	2	41	W
352-93-2	Diethyl Sulfide	29.4	7.97	40.0	10.9	9.435	31	41	
109-79-5	n-Butyl Mercaptan	180	48.7	182	49.5	49.1	2	41	
624-92-0	Dimethyl Disulfide	320	83.1	309	80.2	81.65	4	41	
616-44-4	3-Methylthiophene	362	90.3	350	87.3	88.8	3	41	
110-01-0	Tetrahydrothiophene	65.1	18.1	67.1	18.6	18.35	3	41	
638-02-8	2,5-Dimethylthiophene	32.6	7.10	38.8	8.45	7.775	17	41	
872-55-9	2-Ethylthiophene	29.9	6.51	38.0	8.28	7.395	24	41	
110-81-6	Diethyl Disulfide	ND	ND	ND	ND	-	-	41	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

W = Result quantified, but the corresponding peak was detected outside of generated retention time window.

LABORATORY REPORT

October 3, 2012

Tim Pool
Aquaterra Environmental Solutions, Inc.
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: Cottonwood Hills 2012 Flare Sampling / 4733.11

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on October 2, 2012. For your reference, these analyses have been assigned our service request number P1204038.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA200007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L11-203; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-12-3; Minnesota Department of Health, NELAP Certificate No. 362188; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA01527Z012-Z; Los Angeles Department of Building and Safety, Approval No: TA00001. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Sue Anderson
Project Manager

Client: Aquaterra Environmental Solutions, Inc. Service Request No: P1204038
Project: Cottonwood Hills 2012 Flare Sampling / 4733.11

CASE NARRATIVE

The samples were received intact under chain of custody on October 2, 2012 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Sulfur Analysis

The samples were analyzed for twenty sulfur compounds per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide are quantitated against the initial calibration curve for methyl mercaptan.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

Use of Columbia Analytical Services, Inc. dba ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to AALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

DETAIL SUMMARY REPORT

Client: Aquaterra Environmental Solutions, Inc.
Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

Service Request: P1204038

Date Received: 10/2/2012
Time Received: 09:55

ASTM D5504-01 - Sulfur Bag

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	
CWH #1	P1204038-001	Air	10/1/2012	13:50	X
CWH #2	P1204038-002	Air	10/1/2012	13:55	X
CWH #3	P1204038-003	Air	10/1/2012	14:00	X



Air - Chain of Custody Record & Analytical Service Request

Page 1 of 1

Requested Turnaround Time in Business Days (Surcharges) please circle

1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

CAS Project No.

912024038

[illegible]

4 of 12

WM100683

Sample Acceptance Check Form

Client: Aquaterra Environmental Solutions, Inc. Work order: P1204038
Project: Cottonwood Hills 2012 Flare Sampling / 4733.11
Sample(s) received on: 10/2/12 Date opened: 10/2/12 by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by CAS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1204038-001.01	1 L Zefon Bag					
P1204038-002.01	1 L Zefon Bag					
P1204038-003.01	1 L Zefon Bag					

Explain any discrepancies: (include lab sample ID numbers): _____

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #1
Client Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

CAS Project ID: P1204038
 CAS Sample ID: P1204038-001

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: 10/1/12
Time Collected: 13:50
Date Received: 10/2/12
Date Analyzed: 10/2/12
Time Analyzed: 10:24, 10:57
Volume(s) Analyzed: 1.0 ml(s)
 0.010 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	850,000	700	610,000	500	D
463-58-1	Carbonyl Sulfide	5,300	12	2,200	5.0	
74-93-1	Methyl Mercaptan	20,000	9.8	10,000	5.0	
75-08-1	Ethyl Mercaptan	500	13	200	5.0	
75-18-3	Dimethyl Sulfide	24,000	13	9,500	5.0	
75-15-0	Carbon Disulfide	4,200	7.8	1,400	2.5	
75-33-2	Isopropyl Mercaptan	4,500	16	1,500	5.0	
75-66-1	tert-Butyl Mercaptan	1,300	18	350	5.0	
107-03-9	n-Propyl Mercaptan	270	16	88	5.0	
624-89-5	Ethyl Methyl Sulfide	200	16	64	5.0	
110-02-1	Thiophene	5,500	17	1,600	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	37	18	10	5.0	
109-79-5	n-Butyl Mercaptan	180	18	48	5.0	
624-92-0	Dimethyl Disulfide	570	9.6	150	2.5	
616-44-4	3-Methylthiophene	280	20	71	5.0	
110-01-0	Tetrahydrothiophene	81	18	22	5.0	
638-02-8	2,5-Dimethylthiophene	120	23	26	5.0	
872-55-9	2-Ethylthiophene	40	23	8.7	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #2
Client Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

CAS Project ID: P1204038
 CAS Sample ID: P1204038-002

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: 10/1/12
Time Collected: 13:55
Date Received: 10/2/12
Date Analyzed: 10/2/12
Time Analyzed: 10:38, 10:56
Volume(s) Analyzed: 1.0 ml(s)
 0.010 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	990,000	700	710,000	500	D
463-58-1	Carbonyl Sulfide	520	12	210	5.0	
74-93-1	Methyl Mercaptan	1,500	9.8	750	5.0	
75-08-1	Ethyl Mercaptan	41	13	16	5.0	
75-18-3	Dimethyl Sulfide	1,900	13	740	5.0	
75-15-0	Carbon Disulfide	330	7.8	110	2.5	
75-33-2	Isopropyl Mercaptan	360	16	120	5.0	
75-66-1	tert-Butyl Mercaptan	110	18	30	5.0	
107-03-9	n-Propyl Mercaptan	21	16	6.7	5.0	
624-89-5	Ethyl Methyl Sulfide	19	16	6.2	5.0	
110-02-1	Thiophene	400	17	110	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	47	9.6	12	2.5	
616-44-4	3-Methylthiophene	22	20	5.4	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH #3
Client Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

CAS Project ID: P1204038
 CAS Sample ID: P1204038-003

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: 10/1/12
Time Collected: 14:00
Date Received: 10/2/12
Date Analyzed: 10/2/12
Time Analyzed: 11:18, 11:38
Volume(s) Analyzed: 1.0 ml(s)
 0.010 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	1,000,000	700	730,000	500	D
463-58-1	Carbonyl Sulfide	6,600	12	2,700	5.0	
74-93-1	Methyl Mercaptan	24,000	9.8	12,000	5.0	
75-08-1	Ethyl Mercaptan	590	13	230	5.0	
75-18-3	Dimethyl Sulfide	27,000	13	10,000	5.0	
75-15-0	Carbon Disulfide	4,600	7.8	1,500	2.5	
75-33-2	Isopropyl Mercaptan	5,200	16	1,700	5.0	
75-66-1	tert-Butyl Mercaptan	1,400	18	380	5.0	
107-03-9	n-Propyl Mercaptan	320	16	100	5.0	
624-89-5	Ethyl Methyl Sulfide	230	16	73	5.0	
110-02-1	Thiophene	6,100	17	1,800	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	33	18	9.1	5.0	
109-79-5	n-Butyl Mercaptan	180	18	48	5.0	
624-92-0	Dimethyl Disulfide	580	9.6	150	2.5	
616-44-4	3-Methylthiophene	300	20	75	5.0	
110-01-0	Tetrahydrothiophene	80	18	22	5.0	
638-02-8	2,5-Dimethylthiophene	160	23	34	5.0	
872-55-9	2-Ethylthiophene	49	23	11	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

CAS Project ID: P1204038
CAS Sample ID: P121002-MB

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: NA
Time Collected: NA
Date Received: NA
Date Analyzed: 10/02/12
Time Analyzed: 07:56
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

CAS Project ID: P1204038
CAS Sample ID: P121002-MB

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: NA
Time Collected: NA
Date Received: NA
Date Analyzed: 10/02/12
Time Analyzed: 07:57
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

CAS Project ID: P1204038
CAS Sample ID: P121002-LCS

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Wade Henton
Sampling Media: 1 L Zefon Bag
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 10/02/12
Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppbV	Result ppbV	% Recovery	CAS	Data Qualifier
					Acceptance Limits	
7783-06-4	Hydrogen Sulfide	2,380	2,730	115	51-141	
463-58-1	Carbonyl Sulfide	2,470	2,200	89	63-147	
74-93-1	Methyl Mercaptan	2,360	3,240	137	54-156	

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills 2012 Flare Sampling / 4733.11

CAS Project ID: P1204038
 CAS Sample ID: P121002-LCS

Test Code: ASTM D 5504-08
 Instrument ID: Agilent 7890A/GC22/SCD
 Analyst: Wade Henton
 Sampling Media: 1 L Zefon Bag
 Test Notes:

Date Collected: NA
 Date Received: NA
 Date Analyzed: 10/02/12
 Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppbV	Result ppbV	% Recovery	CAS	Data Qualifier
					Acceptance Limits	
7783-06-4	Hydrogen Sulfide	2,380	2,700	113	51-141	
463-58-1	Carbonyl Sulfide	2,470	2,310	94	63-147	
74-93-1	Methyl Mercaptan	2,360	3,210	136	54-156	

APPENDIX C
CALCULATIONS

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CWH-4		
Date Collected	1/26/2012		
Percent Methane:		51.2	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol	$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) =$	802,000 J/g mole
B) J/mole to cal/mole	$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) =$	191,682.6 cal/g mole
C) cal/mole to Kcal/mole	$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) =$	191.7 kcal/g mole

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 512000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 17.08 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CWH-5		
Date Collected	1/26/2012		
Percent Methane:		53.5	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 535000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 17.85 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input _____

Sample No.	CWH-6		
Percent Methane:		52	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 520000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 17.35 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CWH #4		
Date Collected:	10/1/2012		
Percent Methane:		48.2	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 482000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 16.08 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input _____

Sample No.	CWH #5		
Date Collected:	10/1/2012		
Percent Methane:		48.3	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum CiHi$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

Ci: concentration of component sample component *i* in ppm

Hi: net heat of combustion for sample component *i*
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum CiHi$$

$$H (T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 483000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H (T) = 16.11 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CWH #6		
Date Collected:	10/1/2012		
Percent Methane:		47.4	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 474000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 15.81 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.